



# TECHNICAL UNIVERSITY OF MOMBASA

School of Applied and Health Sciences

## DEPARTMENT OF MATHEMATICS AND PHYSICS

UNIVERSITY EXAMINATIONS 2024/2025

FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN APPLIED PHYSICS IN ELECTRONIC & INSTRUMENTATION

### EEE 4352: INSTRUMENTATION SYSTEMS

END OF SEMESTER EXAMINATIONS

SERIES: APRIL, 2025

TIME: 2 HOURS

#### Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions. Question ONE is Compulsory attempt any other TWO questions.

**Do not write on the question paper.**

#### QUESTION ONE

- (a) (i) Define class A bias as applied in power amplifiers  
 (ii) In a class A power amplifier, the load can be connected either directly in the collector or through a transformer.  
 (I) State TWO reasons why the latter method is preferred.  
 (II) State the type of transformer used. (4 marks)
- (b) Show with relevant diagrams that the maximum collector efficiency of class A bias transformer coupled power amplifier is 50%. (8 marks)
- (c) (i) Define modulation  
 (ii) State the need for modulation  
 (iii) Draw the frequency spectrum of amplitude modulated wave  
 (iv) If a wireless transmitter radiates 4kW with unmodulated carrier wave, and 4.8 kW, when the carrier wave undergoes a sinusoidal variation of amplitude. Calculate the percentage modulation employed. Assume distortion to be negligible. (8.5 marks)
- (d) (i) Draw a block diagram of a baseband pulse code modulation system  
 (ii) State TWO advantages and TWO disadvantages of digital communication. (9.5 marks)

#### QUESTION TWO

- (a) Consider push-pull class A amplifier.  
 (i) State the reason for using push-pull operation  
 (ii) Draw a push-pull class A amplifier using two transistors  
 (iii) State THREE advantages of push-pull class system. (13.5 marks)
- (b) A sinusoidal signal  $v_s = 1.5 \sin 500t$  is feed to an amplifier. The resulting output current is of the form  $i_o =$

$10\sin 500t + 1.5\sin 1000t + 1.2\sin 1500t$ . Calculate:

- (i) second and third harmonic distortion
- (ii) percentage increase in power because of distortion. **(6.5 marks)**

**(c) QUESTION THREE**

- (a)
  - (i) Define noise in amplifiers
  - (ii) Name and describe the different types of noise in amplifiers **(5 marks)**
- (b)
  - (i) State Nyquist theorem
  - (ii) With aid of relevant diagrams describe how an analog signal can be converted into PCM (pulse code modulation) **(9 marks)**
- (c) The sampling rate for each speech channel on the 30 channel PCM system is 8 kHz and each sample is encoded into eight bits. Determine:
  - (i) the transmission or bit rate for the system
  - (ii) the duration of the time slot
  - (iii) the duration of a frame and multi-frame. **(6 marks)**

**QUESTION FOUR**

- (a) Discuss class AB amplify with aid of diagrams. **(7.5 marks)**
- (b) A large signal has an efficiency of 15% and delivers an output power of 4.5W to a resistive load. Calculate the d.c power taken from the supply and the power dissipated under signal conditions. **(3.5 marks)**
- (c) State THREE advantages and THREE disadvantages of using class B amplifiers. **(6 marks)**
- (d) State THREE reasons why practical circuits, it is desirable to avoid the use of transformers.

**(3 marks)**

**QUESTION FIVE**

- (a)
  - (i) Define demodulation
  - (ii) Draw the linear diode detector of AM signals and explain its principle of operation. **(14 marks)**
- (b) State THREE drawbacks of amplitude modulation and explain them. **(6 marks)**